

TEMPLE-INGERSOLL "ELECTRIC-AIR" ROCK DRILLS

INGERSOLL-RAND COMPANY

11 BROADWAY, NEW YORK

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THE great flexibility and economy of electric transmission systems, and the well-known efficiency of the electric generator and motor, have long maintained an interest in the problem of applying their advantages to rock drilling, even in the face of repeated failure.

Almost numberless attempts along this line have produced the many "electric" drills which have from time to time been exploited with varying, but never satisfactory, results. Economical of power they certainly have been, but when measured by the true standard of sustained economy, involving power and repair costs per foot of hole drilled, day after day and month after month over a long period, their performance has fallen so far behind that of the old reliable air drill that they never secured any foothold in the practical field. They took little power, but they did little work — and they were very costly to keep up.



One of Four "5-C" ELECTRIC-AIR Drills at Work on the
Bodensee-Toggenburg Railroad in Switzerland

TEMPLE-INGERSOLL "ELECTRIC-AIR" ROCK DRILLS

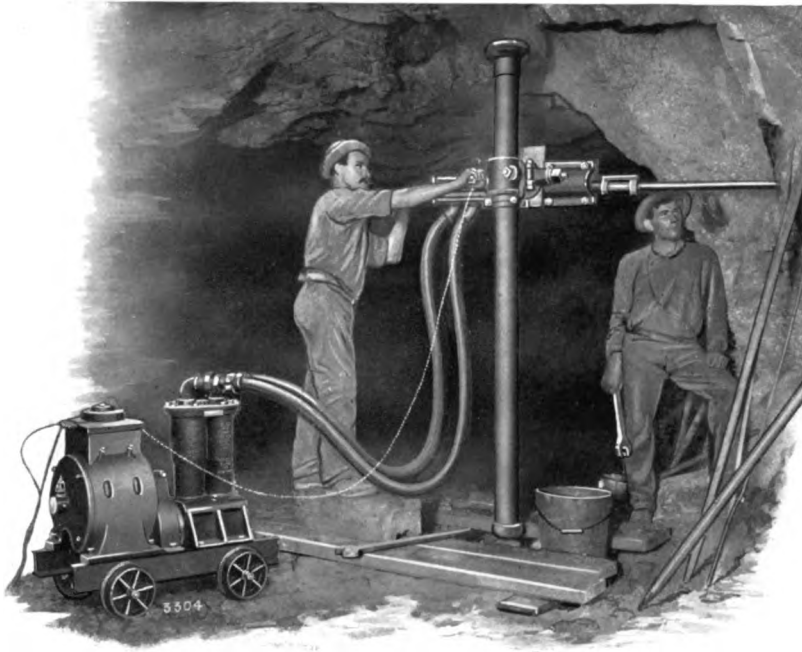


Putting in Test Holes in a Sewer Tunnel

The problem of rock drilling by electric power remained, however, until the Temple-Ingersoll "Electric-Air" Drill was offered to the trade as a complete solution. The fact that this drill makes its appearance with the endorsement of the largest builders of air drills in the world at once stamps it as a practical and reliable device, fully conforming with common-sense rock drill standards.

Not an Experimental Machine

For more than four years the "Electric-Air" Drill has been in successful operation in all classes of rock work and in most of the principal countries in the world. The original drills of this type are still at work in Colorado mines where the machine was introduced and developed. To date (September, 1910) over one thousand of these machines have been sold.



Tunnel Driving with the ELECTRIC-AIR Drill

Description

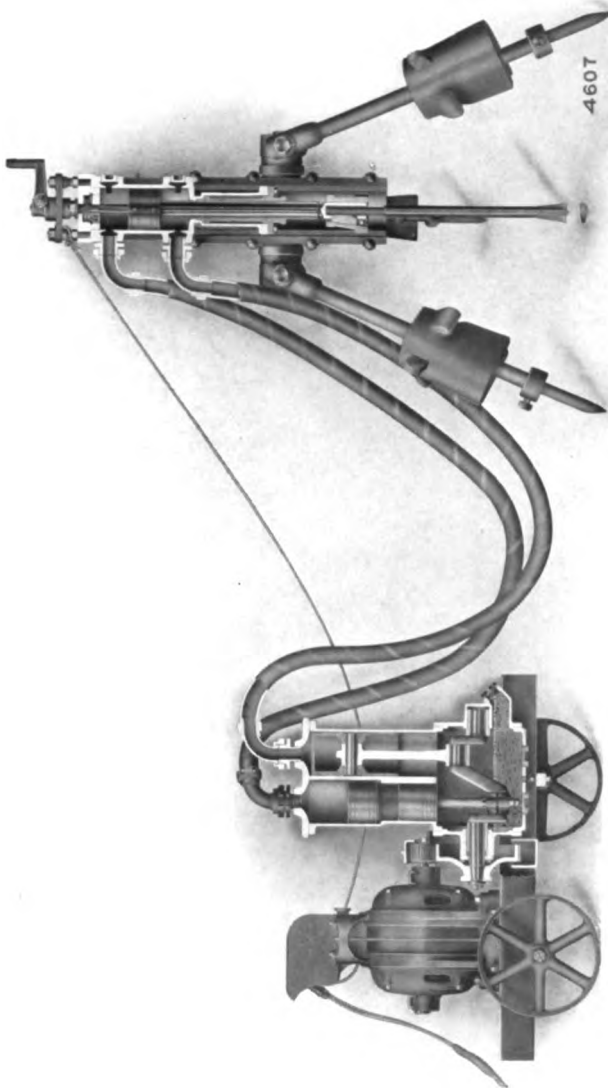
The "Electric-Air" Drill is an air drill driven by pulsations of compressed air created by a duplex air pulsator actuated by a standard electric motor. The air is never exhausted but is simply used over and over again, playing back and forth in a closed circuit.

The drill is the simplest type possible — a cylinder containing a moving piston and rotation device, with no valves, chest, buffers, springs, side rods or pawls. The cylinder is larger but the piston is shorter, making the weight of the drill unit about the same as, or even less than, that of the corresponding air drill.

The pulsator is a vertical duplex single-acting air compressor with opposed cranks, but with no intake or discharge valves or water jackets. It is geared to a motor, either direct or alternating current, and mounted on a wheeled truck for easy handling.

Two short lengths of hose connect pulsator and drill, each running from one pulsator cylinder to one end of the drill cylinder and serving as a port for air admission and return.

TEMPLE-INGERSOLL "ELECTRIC-AIR" ROCK DRILLS



Elevation of ELECTRIC-AIR Drill, partly in Section



ELECTRIC-AIR Drill in a Colorado Tunnel

The complete outfit is of the utmost simplicity, giving satisfactory results in the hands of such practical men as are everywhere available on work demanding machine drills.

Why the System is Economical

The ordinary air or steam driven rock drill takes a full cylinder of air or steam at full

pressure each stroke, and exhausts or discharges it to atmosphere at practically full pressure. No advantage, therefore, is taken of the expansive properties of the air or steam, representing an amount of power wasted without doing useful work.

The "Electric-Air" Drill operates on an entirely different principle. The closed system is filled with air under a low pressure, which is simply a transmitting agent between the piston of the pulsator and the piston of the drill itself. The object of slightly compressing this air is to give it a greater density for the transmission of the pulsations imparted to it by the pulsator. In fact,



The ELECTRIC-AIR Drill at Work in Close Quarters

the air in the system may be considered as an unwearing, unbreakable spring or cushion between the pulsator and the drill. The pressure in the air simply gives the requisite tension to this spring. Practically

the only loss of power is that consumed in overcoming the friction of the mechanism. There may be said to be no loss between the pulsator and drill.

Compensation for Leakage

Some leakage of air from the system is inevitable. This is provided for by a compensating valve on the pulsator which is adjusted to automatically maintain the requisite pressure in the circuit. When pressure falls below this determined limit, due



ELECTRIC-AIR Drill Used for Testing Coal Veins in an Anthracite Mine

to leakage somewhere, this valve automatically opens and admits a small volume of free air which is compressed by a differential area on one of the pulsator pistons until the normal working pressure is restored. But the wearing surfaces throughout the system are so large and the lubrication is so perfect that leakage is very slight, provided the cup leather of the drill is occasionally renewed.

Power Consumption

The 5-C "Electric-Air" Drill uses, under ordinary conditions, about 5 H.P. at the pulsator; the "4-E" uses about 4 H.P.; and the



A "5-C" ELECTRIC-AIR Drill in the Mine
of the West Hecla Mining Company
Burke, Idaho

"3-C" about 3 H.P. These figures mean nothing unless taken in connection with the fact that the "Electric-Air" Drill, with these motors, does as much work as the equivalent air drill using three or four times the power. Following back throughout the system to the electric generating plant and allowing for all rea-

sonable loss in the electric system, the power required per drill at the power house for the "Electric-Air" Drill is only one-third or one-fourth that which the ordinary rock drill requires. A recent instance showed a power cost per shift for the "Electric-Air" Drill of 62½ cents and in another case the user stated that his power cost was practically negligible.

Drilling Capacity

The "Electric-Air" Drill is sold under a guarantee to do as much work as a standard air drill of equivalent rated capacity with 80 pounds air pressure. More specifically, the 5-C "Electric-Air" Drill corresponds in capacity to a standard 3¼-inch air or steam rock drill; the "4-E," to a 3-inch rock drill; and the "3-C," to a standard 2-inch rock drill.

This guarantee is all the statement of capacity required by those familiar with the work of rock drills of standard type.



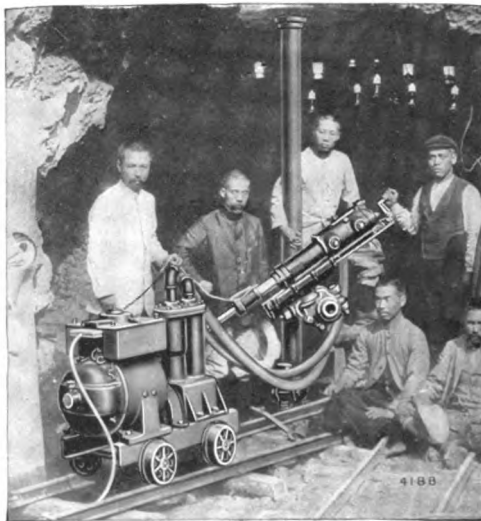
ELECTRIC-AIR Drill on 10-Foot
Muck Pile in Tunnel Heading

Mudding Quality

A common weakness of all "electric drills has been their short stroke. They consequently would not "mud" well and required frequent changes of steel that the hole might be cleaned. The "Electric-Air" Drill has a stroke equal to, or even greater than, that of the air driven rock drill of corresponding capacity; and the peculiar nature of its return stroke, and the quick, powerful action give splendid "mudding" qualities. The length of stroke is varied simply by cranking forward in the shell; and both stroke and force of blow may be adjusted by the same means for fast drilling under any circumstances. If a hole does "mud up" or form a "mud collar" in bad rock, the machine can be backed out without injury while running, thus clearing itself quickly. Its action covers a range from the shortest stroke and the lightest blow possible with an air drill, up to a long stroke and an unmattched crushing blow.

Pulling-Out Power

When the ordinary rock drill, whether steam or air driven, sticks or "fitchers," it simply pulls back with a steady pressure and the steel must be sledged until it loosens. The "Electric-Air" Drill, on the contrary, when it does momentarily stick, receives on its piston upwards of 400 alternating pulls and pushes per minute; and this repeated pulsation has a tendency to promptly loosen and dislodge the stuck bit, except, of course, where a dull bit has become wedged.



ELECTRIC-AIR Drill in Japan

The Question of Endurance

Every "electric" drill has failed because of the failure of some of its vital and delicate parts to withstand the terrific strains of rock drilling. They have been of two general types; either the motor was on the drill, or it was connected to the drill by a flexible

shaft. In the first case considerations of portability demanded a light and weak construction which would not stand the jar and vibration, while the motor must be small and light, incapable of handling the heavy overload encountered in a bad hole; and the insulation soon gave out under the shock and continuous vibration. In the second case the flexible shaft was a delicate mechanism subject to rapid wear and frequent injury in handling, or by a fall of rock. In both cases cams, springs, belts and other undesirable elements were required and the drill was limited to a short stroke with the consequent drawbacks.

The "Electric-Air" Drill avoids all such difficulties by simply eliminating all delicate parts. Those parts which remain are of the best materials, specially treated by the methods which have made the unmatched endurance records of Ingersoll-Rand rock drills. A standard motor is used, equal to the heaviest momentary overload, and mounted on a truck entirely separate from the drill,



ELECTRIC-AIR Drill in a Mexican Mine

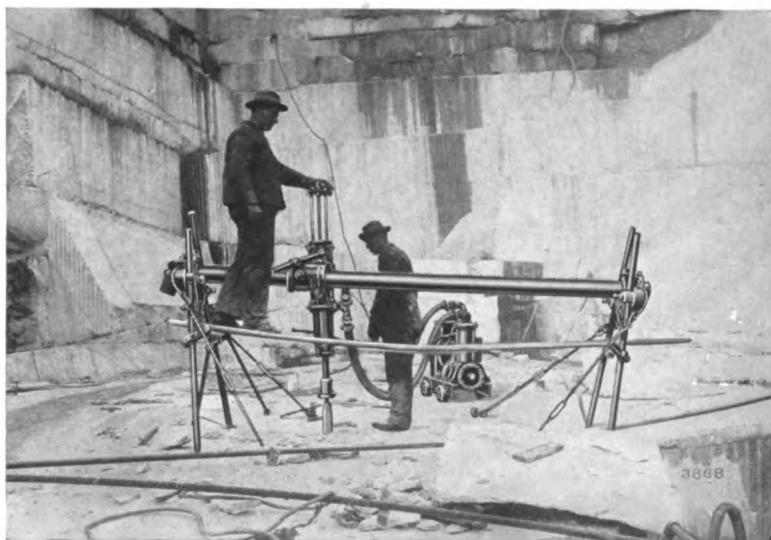
therefore free from vibration and jar. The transmission is by compressed air — cheap and unbreakable — playing back and forth in a closed circuit. Nothing can be simpler than this mechanism throughout.

Perfect Cushioning

In operation the "Electric-Air" Drill has every desirable feature of the most perfect air drill. The cushioning is such that the piston, in running, does not normally strike either front or back head. This makes very easy the problem of handling it in all kinds of drilling. It can be adjusted to strike a terrific blow up to the point of shattering or bending the heavy steels used; or it can be run at full stroke without striking a head, in case a seam or "bug-hole" is encountered. When a hole is to be reamed the motor is thrown on a lower speed; or where single-speed motor is used the drill can be run on a shorter stroke. In backing through a "mud collar," in working through a "pocket," a diagonal seam or a soft spot, or in starting a hole on a glancing surface, the machine approaches in its performance the drill runner's ideal.

Lubrication

The system of lubrication of the "Electric-Air" Drill is automatic and complete, the "splash" method being employed. The closed crank case of the pulsator is partially filled with oil into which the cranks, in their rotation, dip and splash the lubricant



ELECTRIC-AIR Drill on a Quarry Bar Working in Barre Dark Granite



ELECTRIC-AIR Drill Working on a Bench in a Kentucky Limestone Quarry

into the cylinder bores and over all pulsator bearings. While most of this oil drains back to the crank chamber, a portion is atomized and carried through with the air into the drill.

The Field of the "Electric-Air" Drill

The field of the "Electric-Air" Drill, broadly speaking, is the mine, tunnel, quarry, contract, or wherever rock is to be drilled. Whether this machine or the standard air drill should be used in a given case is a question of fuel cost, operating economy, availability of electric power and the distribution of the work. The "Electric-Air" Drill will do all that an air or steam drill can do. Compared, therefore, on the basis of drilling capacity, there is no choice between the two.

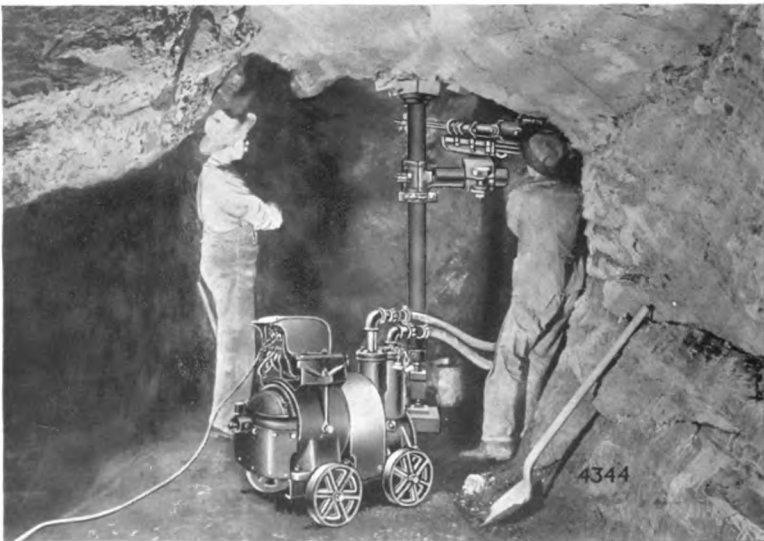
But where electric power is available and cheaper than air or steam power, due to high fuel cost; where high altitudes impair the efficiency of the ordinary air compressor; where pipe lines would be objectionable in an ordinary air drill plant; where electric distribution of power and its attendant uses and advantages are a controlling factor—these are the places where the "Electric-Air" Drill offers the best combination of maximum work output with minimum cost. Other conditions, too, may arise which, when examined in the light of the Company's experience, will recommend the new drill over the old.

The customer who entrusts his rock drilling problem to the Ingersoll-Rand Company may do so with the confidence that he will be furnished with the best and most economical drill for his particular work, whether steam, air or "Electric-Air." This is one of the advantages of dealing with a responsible firm producing a diversified line of machines adapted to all requirements.

The Question of Voltages

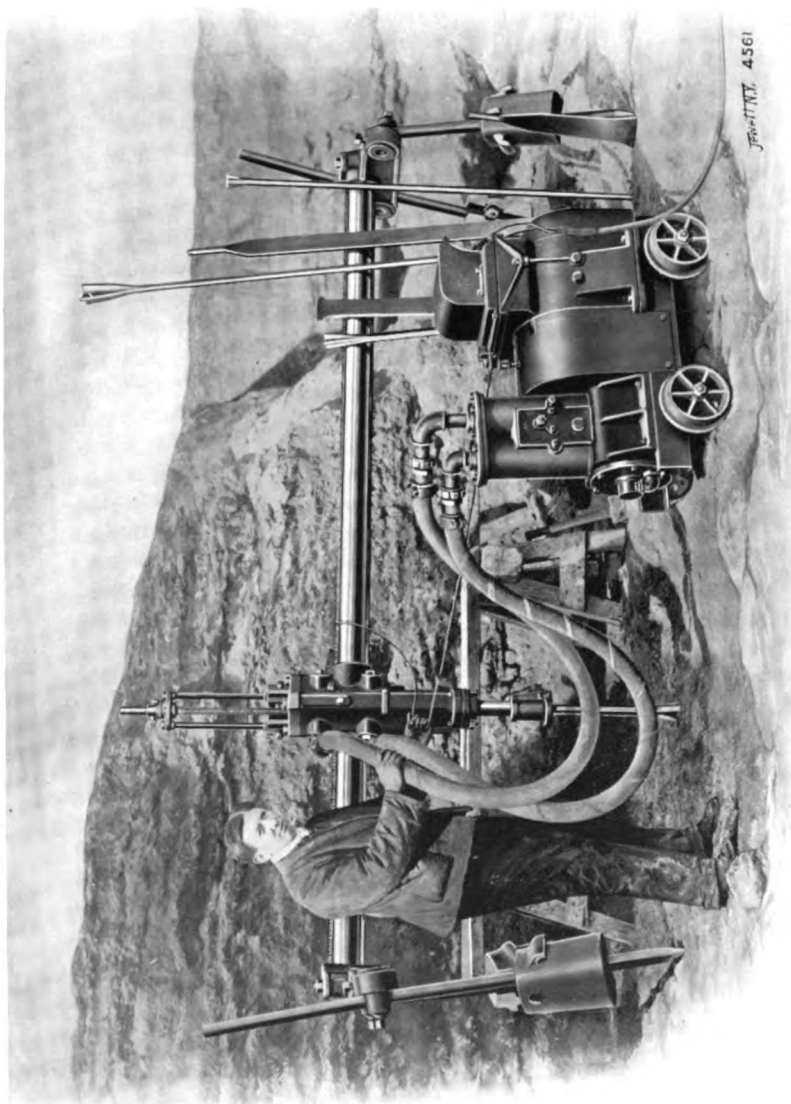
For direct current, 220 volt equipments are considered standard by the Company; for alternating current work, 220 volt, three phase, 25, 30, 50, or 60-cycle motors are standard. The adoption of these standards is the result of observations on hundreds of "Electric-Air" Drills operating under almost all conditions. They represent what in the Company's judgment is the best for all practical purposes on the grounds of safety, economy and general satisfaction.

Motors for 440 and 500 volts D.C. will be furnished on order, though they are not carried in stock. Pressures of over 500 volts are never recommended under any circumstances, and the Company will furnish drills for these higher pressures only where the purchaser will take all the responsibility. These high pressures are called for only where the drill is to operate from an electric circuit already supplying other machines — usually an electric



ELECTRIC-AIR Drill Employed in a Western Irrigation Tunnel

TEMPLE-INGERSOLL "ELECTRIC-AIR" ROCK DRILLS



A "5-C" ELECTRIC-AIR Drill Mounted on a Quarry Bar, at Work in the Quarry of the Deutsche Travertinwerke Langensalza, Thuringia, Germany

haulage system. Under such conditions, the voltage will sometimes fluctuate so widely as almost to forbid the successful operation of the "Electric-Air" Drill.

This is entirely aside from considerations of safety, for 440 volts are dangerous and 500 volts or over are occasionally fatal when encountered. Moreover, insulation and sparking difficulties increase with the voltage; and these high voltage equipments, being special, are a source of difficulty and delay in furnishing duplicate repair parts.

A voltage of 220 is a safe, practical and reliable pressure for "Electric-Air" Drill operation and is also sufficiently high for economical electric transmission. Motors for this pressure are sturdy, dependable machines and standard repair parts are always to be had at short notice. "Electric-Air" Drills seldom work under ideal conditions for electric motors; moisture and dirt must be anticipated. A voltage of 220 reduces trouble from such causes to the minimum; while above this limit difficulties will increase rapidly with the rise of electric pressure.

All new installations for running "Electric-Air" Drills should be made at 220 volts. Where a drill is to be purchased to operate from a circuit at other voltages than this, the matter should be made the subject of correspondence with the Company's engineers with a view to devising a satisfactory adjustment of pressures.

The Character of Current

The advantages and disadvantages of direct and alternating current may be stated in their relation to the "Electric-Air" Drill as follows:

Direct current was first in the field and is probably the most generally used for all purposes today. For this reason it is more familiar and the devices using it are probably better understood than is the case with the alternating current. A local mine or quarry plant is usually direct current and an electrician is regularly maintained, so that all the electrical apparatus is well cared for. The direct current motor for the "Electric-Air" Drill, when mine voltage runs too high, can be operated at three-quarters or nine-tenths its normal speed, by running with the controller on the first or second notch, continuing to do its regular work. When voltage drops below normal the compounding of the motor cares for this, though of course the drilling speed falls off.

The alternating current is usually purchased from a power company, in which case a local electrician is not often employed.

Thus the alternating current motor is less likely to get the care of an expert in its up-keep. But the A.C. motor itself is a simpler, lighter, sturdier machine than the D.C. motor and has no resistance coils, no commutator, no brushes, no uninsulated joints, etc. Power for power, the A.C. motor probably weighs one-third less than the D.C., reducing the weight of the "Electric-Air" outfit materially. The controller for A.C. motors is simpler and more compact than that for D.C. machines.

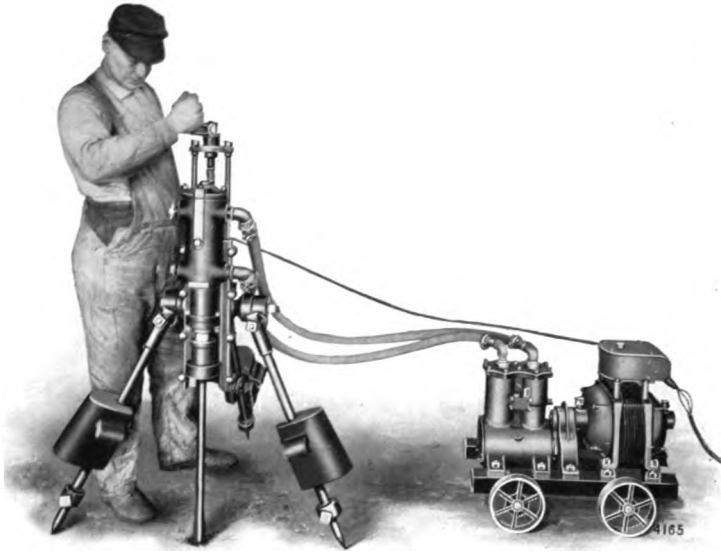
When the question of transmission to a distance is involved the problem becomes one of copper cost. For comparatively short distances direct current can be used if the wires are large enough so that the drill will not suffer under a drop in voltage. For longer distances alternating current should be used, stepped up or generated direct at high voltage for transmission and stepped down to 220 volts at the drill.

Sizes

The line of "Electric-Air" Drills covers all ordinary rock drilling requirements. The three sizes are illustrated in the following pages; and on page 22 the essential facts regarding each are tabulated. The brief descriptions on pages 16, 18 and 20 may, however, be of assistance in drawing the line of distinction between the several sizes.



ELECTRIC-AIR Drill in Austro-Hungary



A Standard "3-C" ELECTRIC-AIR Drill and Pulsator with Tripod Mounting

The "3-C" Drill

The "3-C" is the smallest in the "Electric-Air" series, the line now covering all ordinary demands of rock excavation except that class of work handled by the small hammer drill. This size corresponds with the 2-inch "Sergeant" or "Little Giant" air drill. The power used under average drilling conditions is about 3 H.P. This machine covers the same ground in drilling work as the ordinary "Baby" rock drill and is a thoroughly practical and handy device in its proper field where holes up to 6 feet in depth and of $1\frac{1}{2}$ to $1\frac{3}{4}$ -inch diameter are required, as in mining, stoping, cross-cutting, drifting and quarrying.

DIRECT AND ALTERNATING CURRENT EQUIPMENT WITH "ELECTRIC-AIR" DRILLS, SIZE 3-C

Complete Outfit for 3-C "Electric-Air" Drill and Pulsator When a Direct or Alternating Current Motor is Used.

Drill

One No. 3-C "Electric-Air" Drill complete with A-50 Shell unmounted.

Conductor and Connections

50 feet of flexible protected conductor with connections.

Hose

Two lengths of special hose with couplings, plugs and caps chained together.

Direct Current Motor

One 220 volt Motor geared to Pulsator mounted on truck having flat wheels,† complete with Type 13 Controller, having three running speeds with operating cord.

Alternating Current Motor

One 220 volt Motor (either 25, 40, 50 or 60 cycles) geared to Pulsator mounted on truck having flat wheels,† complete with single speed Type 11 Controller and operating cord.

Mounting

One Double Screw Column with column arm, clamp and wrenches complete, any length specified up to 8 ft. Column may be 3, 3½ or 4-inch size, according to requirements.

OR

One single Screw Column with clamp and wrenches complete, any length specified up to 8 feet. Column may be 3, 3½ or 4-inch size, according to requirements.

OR

One A-86 Tripod with weights and wrenches complete.

Wrenches and Sundries

Suitable wrenches for drill mounting including one (1) each Nos. 63, 18, 152 and 479.

One 12-inch Coe's Monkey Wrench.
One Billings' "D" Adjustable Wrench.
One 4-inch Screwdriver.
One 1½-inch Screwdriver.
One Gear Puller and Bolts.
One Gallon Can Oil.
One M.I. Oil Can.
One Cape Chisel ¾-inch wide.
One Front Crank Bearing Cup Leather.

Two Drill Cup Leathers.
Three Rifle Bar Plunger Springs.
One Piston Bushing.
½ lb. of Fuse Wire.
*Four Carbon Brushes.
One Test Lamp, lamp holder, wire guard and
6 feet flexible twin wire (sent only with
standard 220 volt outfits).

The Following Extras are Necessarily Included as a part of each Equipment, and at an Extra Price

One Front Head.
Four Front Head Bolts and Nuts.
One Brass Nut.
One Rifle Bar.
One Back Ratchet, Nut and Nut Washer with Pin.
Six Rifle Bar Plungers.
Six Rifle Bar Plunger Springs.
Eight A-50 Shell Cap Bolts.
One Piston Chuck.
Six Chuck Pins.
Two Chuck Keys.
Four Back Head Gaskets.
Six Piston Bushings (solid).
Twelve Drill Cup Leathers.

One Pull Back Valve Body.
Two Pull Back Valve Plugs with Handles.
Two Drill Piston Rings.
One Regulating Screw and Jam Nut.
Three Back Ratchet Fibre Washers.
Two Pieces of Bare Hose.
Two 1-inch by 3-inch Nipples.
Four 1-inch by 2-inch Nipples.
Three Front Crank Bearing Cup Leathers.
One Hose Nut.
One Hose Clamp with Bolts and Nuts.
Four Hose Clamp Bolts and Nuts.
Four Hose Gaskets.
Two Terminal Sockets.

† Flanged wheels are furnished on special order.

* Furnished only with Direct Current Equipments.

DIRECT AND ALTERNATING CURRENT EQUIPMENT WITH "ELECTRIC-AIR" DRILLS, SIZE 4-E

Complete Outfit for 4-E "Electric-Air" Drill and Pulsator When a Direct or Alternating Current Motor is Used

Drill

One No. 4-E "Electric-Air" Drill complete with D-24 Shell unmounted.

Conductor and Connections

50 feet of flexible protected conductor with connections.

Hose

Two lengths of special hose with couplings, plugs and caps chained together.

Direct Current Motor

One 220 volt Motor geared to Pulsator mounted on truck having flat wheels,† and complete with Type 13 Controller having three running speeds with operating cord.

Alternating Current Motor

One 220 volt Motor (either 60, 50, 40 or 25 cycles as ordered) geared to Pulsator mounted on truck having flat wheels,† and complete with Type 19 Two-speed Controller with operating cord.

Mounting

One Double Screw Column with arm, clamp and wrenches complete any length specified up to 8 feet. Column may be 4½-inch or 5½-inch size, according to requirement.

OR

One Single Screw Column with clamp and wrenches complete, any length up to 8 feet. Column may be 4½-inch or 5½-inch size according to requirement.

OR

One E-27 Sergeant Tripod with weights and wrenches complete.

Wrenches and Sundries

Suitable Wrenches for drill mounting, including One (1) each Nos. 43, 303, 298 and 39.

One 15-inch Coe's Monkey Wrench.

One Billings' "D" Adjustable Wrench.

One 4-inch Screwdriver.

One 1½-inch Screwdriver.

One Gear Puller and Bolts.

One Gallon Can Oil.

One M.I. Oil Can.

One Test Lamp, lamp holder, wire guard and 6 feet of flexible twin wire (sent only with standard 220-volt outfits).

One Cape Chisel, ⅜ inch wide.

One Extra Front Crank Bearing Cup Leather

Two Extra Drill Cup Leathers.

Three Rifle Bar Plunger Springs.

½ lb. 15-Ampere Fuse Wire.

*Four Extra Carbon Motor Brushes.

One Piston Bushing.

The Following Extras are Necessarily Included as a Part of Each Equipment, and at an Extra Price

One Front Head.

Four Front Head Bolts and Nuts.

One Brass Nut.

One Rifle Bar.

One Back Ratchet, Nut and Nut Washer

with Pin.

Six Rifle Bar Plungers.

Six Rifle Bar Plunger Springs.

Eight D-24 Shell Cap Bolts.

One Piston Chuck.

Six Chuck Pins.

Two Chuck Keys.

Three Back Ratchet Fibre Washers.

Six Piston Bushings.

Twelve Drill Cup Leathers.

Four Back Head Gaskets.

Three Front Crank Bearing Cup Leathers.

One Pull Back Valve Stud.

Two Pull Back Valve Caps and Leathers.

Two Drill Piston Rings.

One Regulating Screw and Jam Nut.

Two Pieces of Bare Hose.

One Swivel Elbow.

One Swivel Elbow Nut.

Four Swivel Elbow Gaskets.

Four Hose Clamp Bolts and Nuts.

Two Terminal Sockets.

† Flanged wheels are furnished on special order.

* Furnished only with Direct Current equipments.



A Standard "5-C" ELECTRIC-AIR Drill and Pulsator with Tripod Mounting

The "5-C" Drill

The largest drill in the "Electric-Air" series is designated by the symbol "5-C." Its proper field of application is the same as that of the larger, heavier air or steam drill, such as the drilling of large, deep holes in tunnel headings, open cut rock work in quarry or heavy contract, and large shaft sinking for any purpose. In drilling capacity it corresponds with the standard $3\frac{1}{4}$ -inch "Sergeant" or "Little Giant" Drill at 80 pounds pressure. It will easily drill holes up to 16 feet in depth with a diameter of from $1\frac{3}{4}$ to $2\frac{3}{4}$ inches. It uses about 5 motor H.P., but the motor furnished has a large reserve of power available in emergency, as when drilling in very difficult ground.

Descriptive Table of Temple-Ingersoll "Electric-Air" Rock Drills

Symbol indicating size and type.....	5-C	4-E	3-C
SPECIFICATIONS:			
Diameter of cylinder.....in.	5 $\frac{3}{8}$	4 $\frac{3}{4}$	3 $\frac{3}{4}$
Length of stroke.....in.	8	7	6 $\frac{1}{4}$
Length of drill from end of crank to end of piston.in.	45	45	39
Depth of hole drilled without change of bit.....in.	24	24	15
Depth of vertical holes each machine will drill easily from 1 to.....ft.	16	12	6
Approximate strokes per minute.....	400	440	475
Diameter of holes drilled as desired from.....in.	1 $\frac{3}{4}$ to 2 $\frac{3}{4}$	1 $\frac{1}{4}$ to 2	1 $\frac{1}{2}$ to 1 $\frac{3}{4}$
Size of octagon steel used.....in.	1 $\frac{1}{8}$ and 1 $\frac{1}{4}$	1 and 1 $\frac{1}{8}$	$\frac{7}{8}$
Size of shanks (diameter and length).....in.	1 $\frac{1}{8}$ by 6	1 by 5 $\frac{1}{2}$	$\frac{3}{8}$ by 5
Number of pieces in set of steels, holes and depths as stated.....	8	6	5
Av. H.P. required for running drill (motor output).....	5	4	3
APPROXIMATE WEIGHTS — DRILL			
Drill, unmounted, with caps, not boxed.....lbs.	299	228	119
Drill, unmounted, with caps, boxed.....lbs.	355	281	155
Hose, fittings and wrenches, not boxed.....lbs.	65	75	35
Hose, fittings and wrenches, boxed.....lbs.	115	150	65
Tripod, without weights, not boxed.....lbs.	296	224	145
Tripod, without weights, boxed.....lbs.	320	260	170
Tripod weights, not boxed.....lbs.	370	336	255
Tripod weights, boxed.....lbs.	400	370	280
Entire equipment, including drill, pulsator, alternating current motor, fittings, wrenches and extra parts, but no mountings, steels or blacksmith tools, boxed.....lbs.	1755	1690	925
Entire equipment, including drill, pulsator, direct current motor, fittings, wrenches and extra parts, but no mountings, steels or blacksmith tools, boxed.....lbs.	1985	1740	1155
APPROXIMATE WEIGHTS WITH PULSATOR ARRANGED FOR DIRECT CURRENT MOTOR			
Pulsator complete, mounted on truck with motor, controller and length of cable, not boxed.....lbs.	1050	950	525
Pulsator complete, mounted on truck with motor, controller and length of cable, boxed.....lbs.	1400	1400	850
Pulsator alone, less truck, not boxed.....lbs.	320	320	88
Pulsator alone, less truck, boxed.....lbs.	370	370	125
Motor alone, not boxed.....lbs.	495	390	274
Motor alone, boxed.....lbs.	600	495	330
Armature alone, not boxed.....lbs.	100	100	60
Armature alone, boxed.....lbs.	125	125	95
D.C. controller type 16 for 5-C and 4-E, type 13 3-C, not boxed.....lbs.	75	75	53
D.C. controller type 16 for 5-C and 4-E, type 13 3-C, boxed.....lbs.	100	100	80
APPROXIMATE WEIGHTS WITH PULSATOR ARRANGED FOR ALTERNATING CURRENT MOTOR			
Pulsator complete, mounted on truck with motor, controller and length of cable, not boxed.....lbs.	1050	950	370
Pulsator complete, mounted on truck with motor, controller and length of cable, boxed.....lbs.	1300	1300	625
Pulsator alone, not boxed.....lbs.	320	320	88
Pulsator alone, boxed.....lbs.	370	370	125
Motor alone, not boxed.....lbs.	375	375	136
Motor alone, boxed.....lbs.	490	490	170
Rotor alone, not boxed.....lbs.	90	90	34
Rotor alone, boxed.....lbs.	120	120	50
A.C. controller type 12 for 5-C, 4-E, type 11 for 3-C, not boxed.....lbs.	34	34	15
A.C. controller type 12 for 5-C, 4-E, type 11 for 3-C, boxed.....lbs.	50	50	35
SHIPPING MEASUREMENTS (OVER ALL)			
Box for unmounted drill.....ft. in.	40 14 14	30 12 12	36 11 10
Box for pulsator, motor and switch mounted on truck and cable.....ft. in.	40 40 32	44 23 310	30 30 24
Box for hose, fittings and wrenches.....ft. in.	210 28 08	31 210 010	24 22 06
Box for pulsator.....ft. in.	26 16 22	22 15 26	20 12 17
Box for motor.....ft. in.	26 110 110	26 110 110	20 10 10
Box for truck.....ft. in.	36 10 09	42 10 09	27 20 010
Box for armature.....ft. in.	30 10 10	26 010 010	23 010 010
Box for "D.C." switch and rheostat.....ft. in.	16 16 10	110 13 13	10 10 08
Box for "A.C." controller switch.....ft. in.	15 10 10	14 11 12	12 10 10
Box for tripod.....ft. in.	39 16 010	45 16 010	30 13 09
Box for tripod weights.....ft. in.	27 11 010	27 10 010	20 010 09

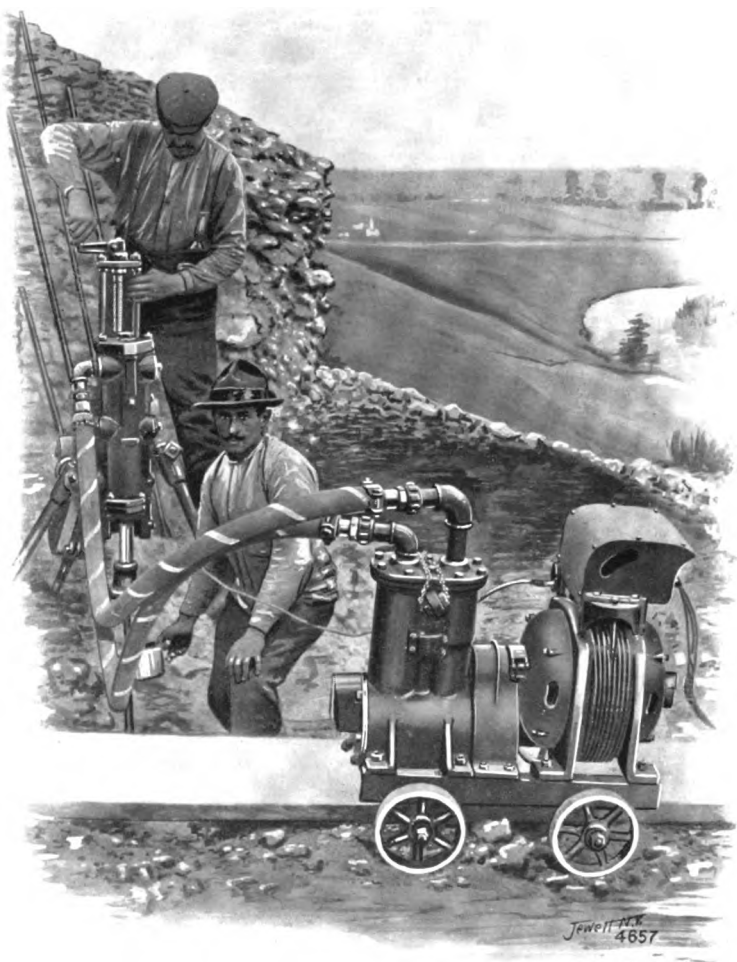
NOTE.—For size and weights of single and double screw columns see separate pamphlet, Form No. 9003.

Engine and Generator Sizes for Operating Temple-Ingersoll "Electric-Air" Drills

Number of Drills	ELECTRICAL POWER AT DRILLS K.W. (INPUT)			EQUIVALENT HORSE-POWER AT THE TERMINALS OF THE DRILL MOTORS (INPUT)			GENERATOR CAPACITY REQUIRED K.W.			EQUIVALENT ENGINE POWER REQUIRED — BRAKE H.P.		
	5-C	4-E	3-C	5-C	4-E	3-C	5-C	4-E	3-C	5-C	4-E	3-C
FOR DIRECT CURRENT OPERATION (For Alternating Current Operation see Notes below)												
1	4.4	3.5	2.2	5.8	4.6	2.9	6.0	4.8	3.0	8.0*	6.4	4*
2	8.1	6.5	4	10.5	8.4	5.2	11	8.8	5.3	14	11.2	7.2
3	11.7	9.4	6	15	12	7.5	16	12.8	7.6	21	16.8	10
4	15	12	8	20	16	10	20	16	10	27	22	14
5	19	15	9	24	19	12	25	20	12	33	26	16
6	22	18	10	28	22	13	29	23	14	39	31	18
7	25	20	12	33	26	16	33	26	16	45	36	21
8	28	22	13	38	30	17	38	30	18	51	41	24
9	31	25	14	41	33	19	42	34	19	56	45	26
10	34	28	15	45	36	20	46	37	20	62	49	27
11	37	30	16	49	39	21	50	40	22	68	54	29
12	40	32	17	52	41	22	54	43	23	72	58	31

*It is necessary to provide more engine and generator capacity for one drill than the average load demands, on account of the requirements of starting and stopping.
 Notes. — The above figures are for average conditions of operation. They do not provide for the simultaneous continuous running of all drills, but only for average intermittent use, as found in ordinary drilling conditions.
 The generator capacities given above allow for the following losses: For direct current work, for a line loss of 8 to 10 per cent; for alternating current work, for a line loss of 8 to 10 per cent and a line power factor of 70 per cent. In other words, an alternating current generator must have a kilo-volt-ampere capacity 30 per cent larger than that listed above under "Generator Capacity."
 Where an alternating current generator is used, the above figures must be increased to allow for the exciter.

TEMPLE-INGERSOLL "ELECTRIC-AIR" ROCK DRILLS



**An ELECTRIC-AIR Drill in the Quarry of the
Stranska Skala Company, Bohemia**